

Tables

TABLE 3-1
CHEMICALS OF CONCERN FOR DIFFERENT PRODUCT RELEASES

Chemical Name	PRODUCT RELEASED					
	Gasoline	Diesel	Jet Fuel	Kerosene	Fuel Oil #2	Used Oil*
Benzene	X	X	X	X	X	X
1,2 Dichloroethane (DCA)	X	-	-	-	-	-
Ethylbenzene	X	X	X	X	X	X
Ethylene dibromide (EDB)	X	-	-	-	-	-
Methyl Tertbutyl Ether (MtBE)	X	-	-	-	-	-
Naphthalene	X	X	X	X	X	X
Toluene	X	X	X	X	X	X
Xylenes (mixed)	X	X	X	X	X	X

Footnotes:

X - Chemical of Concern

"-" - not a chemical of concern

* - for used oil releases as determined through a TPH analysis, TCLP analysis for metals, semi-volatiles and volatiles must be performed to determine the chemicals of concern.

TABLE 3-2
CHEMICAL-SPECIFIC TOXICITY PARAMETERS

CHEMICAL NAME	SLOPE FACTOR			REFERENCE DOSE		
	ORAL [l/(mg/kg-day)]	INHALATION [l/(mg/kg-day)]	DERMAL [l/(mg/kg-day)]	ORAL [mg/kg-day]	INHALATION [mg/kg-day]	DERMAL [mg/kg-day]
Benzene	0.029	0.029	0.029	0.003	0.00171	0.003
1,2 Dichloroethane (DCA)	0.091	0.091	0.091	NA	NA	NA
Ethylbenzene	NA	NA	NA	0.1	0.29	0.1
Ethylene dibromide (EDB)	85	0.77	85	0.000057	0.000057	0.000057
Methyl tertbutyl-Ether (MtBE)	NA	NA	NA	0.05	0.857	0.05
Naphthalene	NA	NA	NA	0.02	0.000857	0.02
Toluene	NA	NA	NA	0.2	0.11	0.2
Xylenes (mixed)	NA	NA	NA	2	2	2

Note: For dermal exposure, oral toxicity values were used.
NA: = Not Available

TABLE 3-3
CHEMICAL-SPECIFIC FATE & TRANSPORT PARAMETERS

CHEMICAL	Koc [cm ³ /g]	Kd [cm ³ /g]	H' [cc-H ₂ O/cc-air]	S [mg/l]	Dair [cm ² /s]	Dwater [cm ² /s]
Benzene	58.2	0.58	0.228	1750	0.09	0.0000098
1,2 Dichloroethane (DCA)	17.5	0.17	0.04	8520	0.1	0.0000099
Ethylbenzene	367	3.6	0.323	169	0.08	0.0000078
Ethylene dibromide (EDB)	28	0.28	0.031	4180	0.07	0.0000081
Methyl tertbutyl Ether (MtBE)	11	0.11	0.024	50000	0.08	
Naphthalene	2010	20.1	0.0198	31	0.06	0.0000075
Toluene	180	1.8	0.272	526	0.09	0.0000086
Xylenes (mixed)	388	3.9	0.234	175	0.08	0.0000084

Definition of Symbols

Koc : Organic carbon partition coefficient

Kd : Soil-water partition coefficient

H : Normalized Henry's Law constant

S: Solubility

Dair: Diffusion coefficient in air

Dwater: Diffusion coefficient in water

Note: Kd = Koc x foc (from Fate and Transport Input Table)

TABLE 3-4
TIER 2 & 3A DEFAULT EXPOSURE PARAMETERS

PARAMETER	SYMBOL	UNITS	VALUE*
Averaging Time			
Carcinogens	AT _c	year	70
Non-Carcinogens	AT _n	year	=ED
Body Weight			
On/Off-site Resident (adult)	BW	kg	70
On/Off-site Resident (child)	BW	kg	15
On/Off-site Commercial Workers	BW	kg	70
Construction Worker	BW	kg	70
Exposure Duration			
On/Off-site Resident (adult)	ED	year	30
On/Off-site Resident (child)	ED	year	6
On/Off-site Commercial Workers	ED	year	25
Construction Worker	ED	year	1
Exposure Frequency			
On/Off-site Resident (adult and child)	EF	days/yr	350
On/Off-site Commercial Workers	EF	days/yr	250
Construction Worker	EF	days/yr	90
Indoor Exposure Time			
On/Off-site Resident (adult)	ET _{in}	hrs/day	12
On/Off-site Resident (child)	ET _{in}	hrs/day	12
On/Off-site Commercial Workers	ET _{in}	hrs/day	8
Construction Worker	ET _{in}	hrs/day	8
Outdoor Exposure Time			
On/Off-site Resident (adult)	ET _{out}	hrs/day	8
On/Off-site Resident (child)	ET _{out}	hrs/day	8
On/Off-site Commercial Workers	ET _{out}	hrs/day	8
Construction Worker	ET _{out}	hrs/day	10
Soil Ingestion Rate			
On/Off-site Resident (adult)	IR _{soil}	mg/day	100
On/Off-site Resident (child)	IR _{soil}	mg/day	200
On/Off-site Commercial Workers	IR _{soil}	mg/day	50
Construction Worker	IR _{soil}	mg/day	480
Ground Water Ingestion Rate			
On/Off-site Resident (adult)	IR _w	L/day	2
On/Off-site Resident (child)	IR _w	L/day	1
On/Off-site Commercial Workers	IR _w	L/day	2
Hourly Outdoor Inhalation Rate			
On/Off-site Resident (adult)	IR _{ao}	m ³ /hr	2.5
On/Off-site Resident (child)	IR _{ao}	m ³ /hr	1.25
On/Off-site Commercial Workers	IR _{ao}	m ³ /hr	2.5
Construction Worker	IR _{ao}	m ³ /hr	2.5
Hourly Indoor Inhalation Rate			
On/Off-site Resident (adult)	IR _{ai}	m ³ /hr	1.67
On/Off-site Resident (child)	IR _{ai}	m ³ /hr	0.84
On/Off-site Commercial Workers	IR _{ai}	m ³ /hr	2.5
Skin Surface Area			
On/Off-site Resident (adult)	SA _{Child}	cm ² /day	5000
On/Off-site Resident (child)	SA _{Adult}	cm ² /day	1750
On/Off-site Commercial Workers	SA _{Comm}	cm ² /day	5000
Construction Worker	SA _{Const}	cm ² /day	7250
Soil to Skin Adherence Factor			
On/Off-site Resident (adult)	M	mg/cm ²	0.2
On/Off-site Resident (child)	M	mg/cm ²	0.2
On/Off-site Commercial Workers	M	mg/cm ²	0.2
Construction Worker	M	mg/cm ²	0.2
Target Risk	TR	***	1E-05
Target Hazard quotient	THQ	***	1

* Exposure Factors Handbook, Volume 1. August 1997. U.S. EPA, Office of Research and Development, Washington DC 20460. EPA/600/P-95/002

TABLE 3-5
TIER 2 & 3A DEFAULT FATE AND TRANSPORT PARAMETERS

PARAMETER	SYMBOL	UNIT	VALUE
SOIL PARAMETERS			
Soil Source Length	W	cm	1500
Depth to Subsurface Soil	L _s	cm	30.48
Thickness of Surficial Soil	d	cm	30.48
Thickness of Capillary Fringe	h _{cap}	cm	5
Thickness of Vadose Zone	h _v	cm	295
Dry Soil Bulk Density	ρ _s	g/cm ³	1.5
Fractional Organic Carbon Content	f _{oc}	g-C/g-soil	0.01
Total Soil Porosity	θ _T	cm ³ /cm ³ -soil	0.43
Volumetric Water Content in Capillary Fringe	θ _{wcap}	cm ³ /cm ³	0.39
Volumetric Water Content in Vadose Zone	θ _{ws}	cm ³ /cm ³	0.15
Volumetric Water Content in Foundation or Wall Cracks	θ _{wcrack}	cm ³ /cm ³	0.15
Volumetric Air Content in Capillary Fringe	θ _{acap}	cm ³ /cm ³	0.04
Volumetric Air Content in Vadose Zone	θ _{as}	cm ³ /cm ³	0.28
Volumetric Air Content in Foundation or Wall Cracks	θ _{acrack}	cm ³ /cm ³	0.28
GROUNDWATER PARAMETERS			
Depth to Groundwater	L _{gw}	cm	300
Hydraulic Conductivity	K	cm/year	90000
Hydraulic Gradient	i	cm/cm	0.01
Groundwater Darcy Velocity	U _{gw}	cm/year	900
Groundwater Mixing Zone Length	L _{mz}	cm	1500
Groundwater Mixing Zone Thickness	δ _{gw}	cm	200
Groundwater Mixing Zone Width	W _{gw}	cm	1500
Infiltration Rate	I	cm/year	30
AMBIENT AIR PARAMETERS			
Breathing Zone Height	δ _a	cm	200
Wind Speed Within the Breathing Zone	U _a	cm/s	225
ENCLOSED SPACE PARAMETERS			
Enclosed Space Air Exchange Rate			
Residential	ER	1/sec	0.00014
Commercial/Construction Worker	ER	1/sec	0.00023
Enclosed Space Volume/Infiltration Area Ratio			
Residential	L _b	cm	200
Commercial/Construction Worker	L _b	cm	300
Enclosed Space Foundation or Wall Thickness			
Residential	L _{crack}	cm	15
Commercial/Construction Worker	L _{crack}	cm	15
Areal Fraction of Cracks in Foundation or Walls			
Residential	η	cm ² /cm ²	0.005
Commercial/Construction Worker	η	cm ² /cm ²	0.005
PARTICULATE EMISSION			
Particulate Emission Factor	PEF	m ³ /kg	1.18x10 ⁹
AVERAGING TIME FOR VAPOR FLUX			
Resident Child	τ	sec	1.89x10 ⁸
Resident Adult	τ	sec	9.46x10 ⁸
Commercial Worker	τ	sec	7.88x10 ⁸
Construction Worker	τ	sec	3.15x10 ⁶
GROUNDWATER USE			
Distance to the Point of Exposure (X _{poe})	X _{poe}	ft	500
Longitudinal Dispersivity	a _x	ft	50
Transverse Dispersivity	a _y	ft	16.67
Vertical Dispersivity	a _z	ft	2.5
Distance to the Point of Compliance (X _{poc})	X _{poc}	ft	10
Longitudinal Dispersivity	a _x	ft	1
Transverse Dispersivity	a _y	ft	0.33
Vertical Dispersivity	a _z	ft	0.05

TABLE 4-1
KDHE TIER 2 RISK-BASED SCREENING LEVELS

Chemical Name	CAS No.	RESIDENTIAL SCENARIOS			NON - RESIDENTIAL SCENARIOS		
		Soil Pathway	Soil to Ground Water Protection Pathway *	Ground Water Pathway	Soil Pathway	Soil to Ground Water Protection Pathway *	Ground Water Pathway
		(mg/kg)	(mg/kg)	(ug/L)	(mg/kg)	(mg/kg)	(ug/L)
Benzene	71-43-2	9.8 n	0.08	5 m	17 c	0.08	5 m
Toluene	108-88-3	930 n	40	1000 m	1000 s	40	1000 m
Ethylbenzene	100-41-4	650 s	55	700 m	650 s	55	700 m
Xylenes (mixed)	1330-20-7	700 s	700 s	10000 m	700 s	700 s	10000 m
1,2 Dichloroethane (DCA)	107-06-2	4.7 c	0.04	5 m	7.3 c	0.04	5 m
Methyl Tertbutyl Ether (MtBE)	1634-04-4	2400 n	0.09	20 h	15000 n	0.09	20 h
Ethylene dibromide (EDB)	106-93-4	0.09 c	0.0006	0.05 m	0.2 c	0.0006	0.05 m
Naphthalene	91-20-3	100 n	39	100 n	320 n	140	350 n
TPH (GRO) **		220	39	500	450	150	500
TPH (DRO) **		2000	3000	500	20000	15000	720

January 22, 2003

Footnotes:

n - non-carcinogenic risk, HI = 1

c - carcinogenic risk, risk = 1×10^{-5}

s - soil saturation

m - primary maximum contaminant level (MCL)

h - health advisory

TABLE 5-1(a)

TIER 3A RISK-BASED SCREENING LEVELS (RBSLs) FOR A RESIDENT CHILD

CHEMICALS OF CONCERN	SURFICIAL SOIL	SUB-SURFACE SOIL	GROUNDWATER
	Inhalation of Vapors and Particulates, Dermal Contact with, and Accidental Ingestion [mg/kg]	Indoor Inhalation of Vapor Emissions [mg/kg]	Indoor Inhalation of Vapor Emissions [ug/L]
Benzene	4.49	0.101	218
Toluene	431	14.7	12300
Ethylbenzene	641 *	70.8	31200
Xylenes (mixed)	706 *	706	175000
1,2 Dichloroethane (DCA)	4.63	0.152	685
Methyl Tertbutyl Ether (MtBE)	1840	160	823000
Ethylene Dibromide (EDB)	0.00831	0.0172	53.9
Naphthalene	48.6	24.2	1410

Note:

Soil concentrations are presented on a dry weight basis.

*: Calculated RBSLs exceeded saturated soil concentration and hence saturated soil concentrations are listed as RBSLs.

TABLE 5-1(b)

TIER 3A RISK-BASED SCREENING LEVELS (RBSLs) FOR A RESIDENT ADULT

CHEMICALS OF CONCERN	SURFICIAL SOIL	SUB-SURFACE SOIL	GROUNDWATER
	Inhalation of Vapors and Particulates, Dermal Contact with, and Accidental Ingestion [mg/kg]	Indoor Inhalation of Vapor Emissions [mg/kg]	Indoor Inhalation of Vapor Emissions [ug/L]
Benzene	10.9	0.112	243
Toluene	1040 *	34.6	28800
Ethylbenzene	641 *	166	73200
Xylenes (mixed)	706 *	706 *	175000 #
1,2 Dichloroethane (DCA)	4.84	0.0714	322
Methyl Tertbutyl Ether (MtBE)	9850 *	376	1930000
Ethylene Dibromide (EDB)	0.0907	0.0214	67.2
Naphthalene	254	5607	3300

Note:

Soil concentrations are presented on a dry weight basis.

*: Calculated RBSLs exceeded saturated soil concentration and hence saturated soil concentrations are listed as RBSLs.

#: Calculated RBSLs exceeded pure component water solubility and hence water solubilities are listed as RBSLs.

TABLE 5-1(c)

TIER 3A RISK-BASED SCREENING LEVELS (RBSLs) FOR A COMMERCIAL WORKER

CHEMICALS OF CONCERN	SURFICIAL SOIL	SUB-SURFACE SOIL	GROUNDWATER
	Inhalation of Vapors and Particulates, Dermal Contact with, and Accidental Ingestion [mg/kg]	Indoor Inhalation of Vapor Emissions [mg/kg]	Indoor Inhalation of Vapor Emissions [ug/L]
Benzene	16.9	0.466	1010
Toluene	1040 *	120	99700
Ethylbenzene	641 *	574	169000 #
Xylenes (mixed)	706 *	706 *	175000 #
1,2 Dichloroethane (DCA)	7.54	0.296	1330
Methyl Tertbutyl Ether (MtBE)	10700 *	1300	6680000
Ethylene Dibromide (EDB)	0.195	0.0889	279
Naphthalene	328	196	11400

Note:

Soil concentrations are presented on a dry weight basis.

*: Calculated RBSLs exceeded saturated soil concentration and hence saturated soil concentrations are listed as RBSLs

#: Calculated RBSLs exceeded pure component water solubility and hence water solubilities are listed as RBSLs.

TABLE 5-1(d)

TIER 3A RISK-BASED SCREENING LEVELS (RBSLs) FOR A CONSTRUCTION WORKER

CHEMICALS OF CONCERN	SOIL TO TYPICAL DEPTH OF CONSTRUCTION	
	Inhalation of Vapors and Particulates, Dermal Contact with, and Accidental Ingestion	
	[mg/kg]	
Benzene	13.5	
Toluene	1040	
Ethylbenzene	641	*
Xylenes (mixed)	706	
1,2 Dichloroethane (DCA)	84.8	
Methyl Tertbutyl Ether (MtBE)	7920	
Ethylene Dibromide (EDB)	0.988	*
Naphthalene	147	*

Note:

Soil concentrations are presented on a dry weight basis.

*: Calculated RBSLs exceeded saturated soil concentration and hence saturated soil concentrations are listed as RBSLs

TABLE 5-2

TIER 3A RBSLs FOR SOIL CONCENTRATIONS (FOR LEACHING TO GROUNDWATER) FOR DIFFERENT DISTANCES TO THE GROUNDWATER EXPOSURE POINT

CHEMICALS OF CONCERN	WATER STANDARD [ug/L]	TIER 3A RBSLs FOR SOIL CONCENTRATION AT THE SOURCE FOR DIFFERENT DISTANCES TO THE EXPOSURE POINT											
		0 ft.	50 ft.	100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.	500 ft.	1000 ft.
		[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]
Benzene	5	0.0183	0.0239	0.0568	0.114	0.194	0.298	0.424	0.573	0.746	0.941	1.16	4.61
Toluene	1000	9.86	12.9	30.6	61.4	105	160	228	309	402	507	624	1040 *
Ethylbenzene	700	13.3	17.4	41.2	82.6	141	216	308	416	541	641 *	641 *	641 *
Xylenes (mixed)	10000	202	264	627	706 *	706 *	706 *	706 *	706 *	706 *	706 *	706 *	706 *
1,2 Dichloroethane (DCA)	5	0.00703	0.00919	0.02318	0.0438	0.0746	0.114	0.163	0.22	0.286	0.362	0.445	1.77
Methyl Tertbutyl Ether (MtBE)	20	0.0214	0.028	0.0665	0.133	0.227	0.348	0.496	0.671	0.872	1.1	1.36	5.39
Ethylene Dibromide (EDB)	0.05	0.0000969	0.000127	0.000301	0.000603	0.00103	0.00158	0.00225	0.00304	0.00395	0.00498	0.00614	0.0244
Naphthalene	350	10	13.1	31.1	62.5	106	163	232	314	409	516	622 *	622 *

Note:

- * Calculated Tier 3A RBSLs for soil concentrations exceeded saturated soil concentration and hence the saturated soil concentrations are listed as the Tier 3A RBSLs for soil concentrations protective of groundwater.
Soil concentrations are presented on a dry weight basis.

TABLE 5-3
TIER 3A DILUTION ATTENUATION FACTORS

Distance from source (feet)	Dilution Attenuation Factor With No Decay (- -)
25	1.01
50	1.3
100	3.1
200	10.6
300	23.2
400	40.8
500	63.4
1000	251.8